

## PATENT COOPERATION TREATY

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## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

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1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

09 January 2001 (09.01.01)

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METHOD APPARATUS AND ARTICLE OF MANUFACTURE FOR A  
BRANDING DIAMOND BRANDING WITH A FOCUSED ION BEAM

BACKGROUND

I. FIELD OF THE INVENTION

5 The present invention relates generally to the field of the handling of precious gems and more specifically to the branding of a design onto a precious gem such as a diamond.

II RELATED ART

10 In the handling, marketing and sale of precious stones, such as diamonds, as well as the sale of jewelry made from these precious stones, it is common practice for jewelers and diamond merchants to grade precious stones to determine their value based on such features as cut, weight, color and the purity of the crystalline structure of the stone. These attributes contribute to much of the value of an individual stone. Conventionally, these attributes are recorded on paper or other media separate from the stone itself. These attributes and the documents which record these attributes typically become a means of both determining the value of the stone and properly identifying its owner. Thus, because this information is so important, this information must be accurately and reliably conveyed to the purchaser of the stone during a sale or other transfer of ownership.

15 It is equally important to the owner of a particular piece of jewelry containing precious stones to be able to accurately identify the piece of jewelry and the individual stone or stones set in that piece of jewelry. Although most luxury and consumer goods carry serial numbers or other indications of ownership, so that owners can verify their ownership of goods of similar appearances, differentiate between genuine goods and counterfeit goods at purchase,

## CLAIMS

1. A method of branding a diamond comprising:  
directing a focused ion beam at the diamond to be branded and controlling the beam such that the beam impacts the surface of the diamond at a number of specified locations for a specified amount of time at each location to graphitize a portion of the diamond in the shape of a desired design.
2. The method of claim 1 wherein the focused ion beam is controlled by a computer.
3. The method of claim 1 wherein the design is not visible to the naked human eye.
4. The method of claim 3 wherein the design is less than 250 micrometers wide at its widest point.
5. The method of claim 3 wherein the design is between about 250 micrometers and 7 nanometers wide at its widest point.
6. The method of claim 1 wherein the focused ion beam is composed of Gallium ions.
7. The method of claim 1 further comprising removing the graphitized portions of

the diamond so that the design is carved into the surface of the diamond.

8. The method of claim 1 wherein the diamond is coated with a conductive layer.
9. The method of claim 8 wherein the conductive layer is carbon.
10. The method of claim 1 wherein the diamond is exposed to a charge neutralizer.
11. A method of branding a diamond comprising the steps of:
  - securing the diamond onto a holder capable of being used in a coordinate transfer system;
  - using the coordinate transfer system to create mapping data which represents the distances between the location on the diamond which will be branded and certain set reference points on the holder;
  - using the mapping data to control a focused ion beam machine such that it produces a focused ion beam which impacts the diamond at a desired location for a desired length of time to brand the design onto the diamond.
12. The method of claim 11 further comprising generating design data which represents the design to be branded onto the diamond; and using the design data in conjunction with the mapping data to control the focused ion beam.
13. The method of claim 11 further comprising the step of coating the diamond with a layer of conductive coating.

14. The method of claim 13 wherein the charged particles are carbon.
15. The method of claim 11 wherein the holder is conductive.
16. The method of claim 15 wherein the holder is aluminum.
17. The method of claim 15 wherein the holder is copper.
18. The method of claim 11 wherein the holder is capable of holding more than one diamond at a time.
19. The method of claim 11 wherein the holder is portable.
20. The method of claim 10 wherein the holder includes at least three reference points.
21. The method of claim 11 wherein the coordinate transfer system identifies at least three reference points on the holder and determines the mapping data which comprises at least a horizontal offset, a vertical offset, and a rotational offset.
22. The method of claim 21 wherein the mapping data is determined for more than one diamond.

23. The method of claim 12 wherein the design data is converted into stream files which comprise data representing the design in the form of pixels and offsets from a local coordinate system.
24. The method of claim 23 wherein the ion beam is controlled to impact the diamond such that the diamond is branded wherein each impacted area corresponds to one pixel of the design.
25. The method of claim 12 further comprises the step of relating a local coordinate system associated with the design to be branded on the diamond to a global coordinate system associated with the mapping data.
26. The method claim 11 wherein the focused ion beam brands the diamond by converting a portion of the diamond into graphite.
27. The method of 26 further comprising the step of removing the graphite.
28. The method of claim 27 wherein the graphite is removed by exposing the branded diamond to potassium nitrate.
29. The method of claim 27 wherein the graphite is removed by exposing the branded diamond to plasma.
30. The method of claim 11 wherein a voltage applied to produce the ion beam is controlled such that the computer is able to vary how far the ion beam penetrates the surface

of diamond and how deeply the diamond is branded.

31. An apparatus for branding a diamond comprising:

a coordinate transfer system controlled by a computer;

a focused ion beam machine controlled by the computer;

one or more computer programs, performed by the computer attached to the coordinate transfer system, for generating mapping data which represent the distances between the location on the diamond which will be branded and certain set reference points on the holder;

one or more computer programs, performed by the computer for using the mapping data to control the focused ion beam machine such that it produces a focused ion beam which impacts the diamond at one or more desired locations for a predetermined length of time to brand the design onto the diamond.

32. The apparatus of claim 31 further comprising one or more computer programs, performed by the computer, for generating design data which represent the design to be branded onto the diamond and using the design data in conjunction with the mapping data to control the focused ion beam machine.

33. The apparatus of claim 31 further comprising a second computer connected to the first computer wherein the first computer performs one or more computer programs for creating mapping data which represent the distances between the location on the diamond which will be branded and certain set reference points on the holder; and the second computer performs one or more computer programs for using the mapping data to control the focused

ion beam machine, such that it produces a focused ion beam which impacts the diamond at a desired location for a desired length of time to brand the design onto the diamond.

34. The apparatus of claim 33 further comprising a third computer connected to the first computer, wherein the third computer performs one or more computer programs for generating design data which represents the design to be branded onto the diamond.

35. The apparatus of claim 34 wherein the design is converted into stream files which comprise data representing the design in the form of pixels and offsets from a local coordinate system.

36. The apparatus of claim 35 wherein the design is a bar-code.